

U.S. Patent Application Serial No. 09/814,618  
Reply to Office Action dated January 4, 2006

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Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (Previously Presented) A three-dimensional image grabber, comprising:

a pattern projecting assembly for simultaneously projecting at least two phase-shifted patterns onto an object; each of said projected patterns being produced by decomposition of one of: a white light and: a non-white light including a plurality of monochromatic lights, into one of: a plurality of monochromatic lights and: non overlapping bandwidths; and

an image acquisition apparatus sensitive to said one of: said plurality of monochromatic lights and: said non-overlapping bandwidths for simultaneously taking an image of each of said projected patterns on the object.

2. (Previously Presented) The three-dimensional image grabber as recited in claim 1, wherein at least one of said at least two phase-shifted patterns is monochromatic.

3. (Previously Presented) The three-dimensional image grabber as recited in claim 1, wherein said pattern projection assembly includes a semi-transparent plate including a pattern to be illuminated by an illuminating assembly, a spectral splitter to be positioned between said semi-transparent plate and said illuminating assembly and a projector for projecting said semi-transparent plate onto said object; said illuminating assembly including a source of white light so positioned as to be projected through said semi-transparent plate.

4. (Previously Presented) The three-dimensional image grabber as recited in claim 3, wherein said illuminating assembly further includes an optical fiber and a condenser for bringing light from said white source to said semi-transparent plate.

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5. (Previously Presented) The three-dimensional image grabber as recited in claim 3, wherein said semi-transparent plate is a grid.
6. (Previously Presented) The three-dimensional image grabber as recited in claim 1, wherein said pattern projection assembly includes at least two pattern projecting apparatuses and a reflecting arrangement; each of said pattern projecting apparatus being configured to project a light having a predetermined bandwidth through a pattern; said reflecting arrangement being so configured as to direct said projected patterns along a common direction of incidence.
7. (Previously Presented) The three-dimensional image grabber as recited in claim 6, wherein at least one of said pattern projecting apparatuses includes a semi-transparent plate including a pattern to be illuminated by an illuminating assembly and a projector for projecting said plate onto said reflecting arrangement; said illuminating assembly including a source of light having a predetermined bandwidth and being so positioned as to be projected through said plate.
8. (Previously Presented) The three-dimensional image grabber as recited in claim 6, wherein said projecting arrangement includes at least one of a mirror and a semi-transparent mirror.
9. (Previously Presented) The three-dimensional image grabber as recited in claim 7, wherein said plate is a grid.
10. (Previously Presented) The three-dimensional image grabber as recited in claim 7, wherein said pattern projecting apparatuses are so positioned relative to each other as to each provide a same distance from said plate to the object.
11. (Previously Presented) The three-dimensional image grabber as recited in claim 1, wherein said image acquisition apparatus includes at least one camera sensitive to one of: said plurality of monochromatic lights and: said non-overlapping bandwidths.

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12. (Previously Presented) The three-dimensional image grabber as recited in claim 11, wherein said image acquisition apparatus includes a telecentric lens.
13. (Previously Presented) The three-dimensional image grabber as recited in claim 1, wherein said image acquisition apparatus includes at least two cameras, each sensitive to one of: said plurality of monochromatic lights and: said non overlapping bandwidths.
14. (Previously amended) The three-dimensional image grabber as recited in claim 11, wherein said camera is selected from the group consisting of a Charge Coupled Device (CCD) camera and a Complementary Metal-Oxide-Silicon (CMOS) device.
15. (Cancelled)
16. (Currently Amended) A system for measuring the relief of an object, said system comprising:  
a pattern projecting assembly for simultaneously projecting at least three phase-shifted patterns onto the object; each of said projected patterns being characterized by a predetermined bandwidth;  
an image acquisition apparatus sensitive to said predetermined bandwidths for taking an image of each of said at least three phase-shifted projected patterns on the object; each of said images including a plurality of pixels having intensity values; and  
a controller configured for:
  - a) receiving from the image acquisition apparatus said at least three images of the projected patterns onto the object;
  - b) computing the object phase for each pixel using the at least three object intensity values for the corresponding pixel; and

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- c) computing the relief of the object at each pixel position using said object phase at the corresponding pixel position; The system as recited in claim 15,

wherein said pattern projecting assembly includes a grid illuminated by an illuminating assembly, a spectral splitter to be positioned between said grid and said illuminating assembly and a projector for projecting said illuminated grid onto said object; said illuminating assembly including a source of white light so positioned as to be projected through said grid.

17. (Currently Amended) A system for measuring the relief of an object, said system comprising:

a pattern projecting assembly for simultaneously projecting at least three phase-shifted patterns onto the object; each of said projected patterns being characterized by a predetermined bandwidth;

an image acquisition apparatus sensitive to said predetermined bandwidths for taking an image of each of said at least three phase-shifted projected patterns on the object; each of said images including a plurality of pixels having intensity values; and

a controller configured for:

- a) receiving from the image acquisition apparatus said at least three images of the projected patterns onto the object;

- b) computing the object phase for each pixel using the at least three object intensity values for the corresponding pixel; and

- c) computing the relief of the object at each pixel position using said object phase at the corresponding pixel position; The system as recited in claim 15, wherein said pattern projection assembly includes at least two pattern projecting apparatuses and a reflecting

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arrangement; each of said pattern projecting apparatus being configured to project a light having a predetermined bandwidth through a pattern; said reflecting arrangement being so configured as to direct said projected patterns along a common direction of incidence.

18. (Currently Amended) The system as recited in claim 16 15, wherein said image acquisition apparatus includes at least one camera sensitive to said predetermined bandwidths.

19. (Currently Amended) The system as recited in claim 16 15, wherein said computer includes memory means for storing said images during their process.

20. (Currently Amended) The system as recited in claim 16 15, wherein said computer includes at least one of a storing device, an input device and an output device.

21. (Currently Amended) The use of the system of claim 16 15, for lead-coplanarity inspection.

22-23. (Cancelled)

24. (Previously Presented) A three-dimensional image grabber, comprising:

a means for simultaneously projecting at least two phase-shifted patterns onto the object; each of said projected patterns being produced by decomposition of one of: a white light and: a non-white light including a plurality of monochromatic lights, into one of: a plurality of monochromatic lights and: non overlapping bandwidths; and

a means for simultaneously taking an image of each of said projected patterns on the object; said image taking means being sensitive to one of: said plurality of monochromatic lights and: said non overlapping bandwidths.

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